UNITED STATES GEOLOGICAL SURVEY

HOLE NO: CE 82-1

LOCATION: SW 1/4 SW 1/4 Section 24, T. 13 N., R. 13 W.,

Tyonek A-5 Quadrangle, Alaska										
COLLAR ELEVATION: 380 m	6	GRAIN SIZE TO ATTERBERG 2/ SLAKE 4/ POINT-LOAD STRENGTH INDEX 5/				<u>5</u> /	UNCONFINED 6/			
	neters) OGY	DISTRIBUTION	LIMITS	— Natural density	DURABILITY		(approximate unconfined compressive strength)		COMPRESSIVE	ULTRASONIC VELOCITY
	TH (m	sand——— silt ——— clay ······	plastic liquid • Natural moisture x Organic content	☐ Dry bulk density ■ Grain density	INDEX	Axial (1)	Diametral (II)	Anisotropy	STRENGTH	Compressional-wave velocity Shear-wave velocity
LITHOLOGIC DESCRIPTION	DEPT	% of dry weight	(%) Percent	in g/cc	% Remaining (after 2 cycles)	MN/m2 1,0 2,0 3.0 4,0 5,0	MN/m ² 1,0 2,0 3,0 4,0 5,0	(<u></u>)/(II) 1,0 2.0	MN/m ² 1.0 2.0 3.0 4.0 5.0	meters/second
Colluvium, peat, volcanic ash, and diamicton, basal organics at approximately 1.05 m, ash layers from 1.05 - 1.2 m, diamicton (glacial till) from 1.2 - 1.4 m		10, 30, 50, 70, 50	10 , 30 , 30 , 70 , 90			1,0 2,0 0,0 0,0	1,0 2,0 0,0 4,0 0,0	1,0 2,0	2.0 0.0 4.0 0.0	500 1000 1500 2000
(glacial till) from 1.2 - 1.4 m Diamicton, light-olive-gray, very fine pebbly glacial till, firm Sandstone, moderate-yellowish-brown, medium-grained, soft, oxidized	$-\Delta^{\Delta}_{\Delta}$			•		-				·
Sandstone, dark-yellowish-brown to moderate-brown, medium-to coarse-grained, poorly sorted, base firm and oxidized, upper interval soft	5—		···			·			•	
Sandstone, moderate-brown to medium-light-gray, very fine- to medium-grained.			-							
poorly sorted, hardness variable with interbedded soft and firm zones, oxidized Sandstone, olive-brown to medium-light-gray, fine-grained, scattered limonitic specs, hardness variable with interbedded soft and firm zones	- - 200 (1985) - 200 (1985)				•					
	10									
finer-grained interval fine- to medium-grained, coarser-grained intervals soft, finer-grained intervals firm Sandstone, grayish-olive-green to moderate-olive-brown, massive, medium-grained	-		-							
grading to fine-grained, well-sorted, high quartz content, firm										
Sandstone, dark-yellowish-brown, massive-medium-grained, moderatly well-sorted subrounded, high quartz content, very soft to soft	15					·				
Sandstone, dark-yellowish-brown, fine- to medium-grained, fine-grained interbeds, primarily subrounded quartz grains, finer-grained beds soft to firm, coarser-grained beds very soft	- 8787									
Siltstone, medium-gray, massive, sandy, micaceous, firm	7000		•							
Siltstone, medium-dark-gray to medium-gray, very finely to finely laminated clayey with occasional coal stringers, carbonate "blebs" scattered	20		•		·					
throughout the lower two-thirds of the unit, firm, grades into unit below			• • • • • • • • • • • • • • • • • • • •	1						
Claystone, olive-gray, massive, few scattered coal inclusions, very firm,	25		× .							
grades into unit below Claystone, brownish-gray, very carbonaceous, finely laminated, thin claystone										
interbeds, fissile				· · · · · · · · · · · · · · · · · · ·				7.2		
Coal, black Sandstone grayish-black, fine-grained with clay and silt, soft	30				3				8.9	
Coal, black- to brownish-black, moderate-yellowish-brown volcanic ash(?) parting from 30.95 - 31.02 m, core highly fractured and broken into	_									
subangular pieces, hard	-									
Coal, black- to brownish-black- to grayish-black, core highly fractured and broken to 35.2 m, from 35.3 - 36.8 m finely laminated, hard	35—			_						
Siltstone, dusky-yellowish-brown to medium-gray, finely laminated, clayey and carbonaceous with decreasing carbonaceous content downwards, firm				· · · · · · · · · · · · · · · · · · ·						
and carbonaceous with decreasing carbonaceous content downwards, firm Siltstone, medium-gray, thin interbeds of fine-grained sand and clayey siltstone, firm, gradational contact with unit below ´	40		. :	•						-
Sandstone, olive-gray to medium-gray, fine- to medium-grained with carbonaceous laminae, 0.6 cm diameter quartz pebble at 40.2 m, firm	40	·		•						
Siltstone, olive-gray, fine-grained sandstone at top, hard Sandstone, medium-dark-gray to medium-gray, massive, very fine-grained, silty with interbeds of coaly fragments from 42.3 - 42.9 m and 43.7 - 44.1 m,	-			•						1
very firm, gradational contact with unit below Siltstone, medium-dark-gray, very finely laminated, clayey, very firm	45				•				-	
Sandstone, medium-light-gray, fine-grained, irregular fragments of bedded siltstone surrounded by sandstone, soft	— 									
Sandstone, medium-light-gray, massive, fine-grained with coal fragments scattered throughout, soft	-									
Siltstone, medium-dark-gray, very finely laminated, very fine-grained sandstone interbeds, small pebbles at base, hard	50	=		•						
Sandstone, medium-gray, massive, medium-grained, well-sorted, soft Interbeds of siltstone, pebbly gravel, clayey siltstone, and medium-grained	- - 									· :
sandstone Sandstone, medium-light-gray, massive, fine- to medium-grained Conglomerate, medium-dark-gray to medium-gray, sandy, very fine-grained,										
subangular to subrounded grains and pebbles, soft Interbeded conglomerate and coarse-grained sandstone, medium-dark-gray, soft siltstone, medium-dark-gray, finely laminated, grades into carbonaceous	55-		-							
siltstone, 0.1 m coal lens from 56.9 - 57.0 m Claystone, medium-gray, finely laminated, silty with coal fragments and carbonate "blebs" scattered throughout, very firm, grades into clayey	-	=								
siltstone at base Siltstone, medium-light-gray, massive, carbonate "blebs" throughout, firm, gradational contact with unit below Claystone, medium-gray to medium-dark-gray, finely laminated at base, coaly,	60		·· •••••	•						+
very firm, grades into carbonaceous claystone, at base Claystone, olive-black, massive, silty, very hard, basal 0.15 m siltstone, brownish-black, sandy with carbonaceous stringers, very hard										
Siltstone, medium-gray to medium-light-gray, massive, grading into clayey siltstone, laminae of wood fragments at 65.6 m, very firm, gradational contact with unit below				1	•					•
Siltstone, medium-dark-gray to medium-gray, massive, sandy grading into clayey siltstone, laminae of wood fragments at 66.3 m, carbonate "blebs"	65									
scattered throughout sandy material, carbonaceous stringers in clayey interval, hard			x	1						
Siltstone, medium-gray, massive, clayey, very firm			:							
Siltstone, medium-gray- to medium-dark-gray, finely laminated, sandy.	70		:							•
very fine-grained with interbeds of clayey siltstone and coal lenses				•						
Siltstone, medium-dark-gray, finely laminated, carbonate "blebs" scattered throughout, firm- to- medium hard, slickensides at 75.9 m, gradational contact with unit below	75			1						
Siltstone, medium-dark-gray, massive, clayey with carbonate "blebs" scattered throughout, very firm		//						. —		
Claystone, medium-dark-gray to brownish-black, very finely laminated, carbonaceous, hard, slickensides from 77.5 - 77.7 m, clayey siltstone from 79.0 - 79.3 m, medium-gray, very hard										
Siltstone, brownish-gray to medium-gray, finely laminated with regular wavy bedding and frequent minor faulting, clayey grading to very fine-grained sandy siltstone by 84.4 m with numerous interbeds of	80									
claystone, siltstone, and very fine-grained sandstone, micaceous, some carbonate "blebs", very firm Siltstone, brownish-gray to medium-gray, finely laminated with flow	-									+ - - - - - - - - - -
structures in the bedding, very firm Siltstone, medium-gray to brownish-gray, finely laminated, interbeded	85									
with claystone and coaly horizons, micaceous, fossil-leaf impression at 85.2 m, firm										
Siltstone, brownish-gray to olive-gray, very finely laminated, clayey, carbonaceous laminae, numerous zones of carbonate "blebs" scattered throughout, very firm, possible slickensides at 87.8 m, gradational contact with unit below, minor fault planes from 89.5 - 89.7 m			· · · · · ·							+
Claystone, dark-grayish-brown to medium-dark-gray, very finely laminated,	90									<u> </u>
carbonaceous to slightly silty, cyclic bedding of lighter and darker silty claystone and claystone from 93.9 - 96.3 m, very hard, slickensides at 93.8 m, gradational contact with unit below	- - -			•				_		·
	95—									
Claystone, brownish-black to brownish-gray, very finely laminated,			•				· · · · · · · · · · · · · · · · · · ·			-
carbonaceous with many thin coal lenses, increasingly carbonaceous downward, very firm Coal, black- to- dusky-yellow-brown, very finely laminated, probably lignite			—							
Claystone, brownish-black to dusky-yellow-brown, very finely laminated, carbonaceous with many thin interbeds of coal, firm	100			•				 		
	-					17.3	10.7			
Coal, brownish-black- to- black, massive to very finely laminated, carbonaceous	405			-			→ <u>1</u> 1.0			
claystone from 109.1 - 109.3 m, tuff(?) lens at 109.5 m, hard, high-angle fractures throughout upper two-thirds of coal interval, no recovery zone from 110.6 - 110.7 m	105-									
									18.2	
Sandstone, medium-gray to medium-light-gray, massive, fine- to medium-grained,	110-		•	<u></u>						
primarily subangular quartz and black phaneritic grains, coal lenses in upper half, hard in coaly zone, soft to very soft below Siltstone, medium-gray to medium-light-gray, massive, clayey with occasional coal laminae at various angles to the horizontal, firm, carbonate-cemented			:		•	-				.
siltstone from 112.55 - 112.85 m, medium-brownish-gray, very hard Sandstone, medium-gray, finely laminated, very fine- to medium-grained.			: :							-
'slightly silty, micaceous, soft and friable	T.D. 114	.6	•			'	-			

EXPLANATION

DIAMICTON

SANDSTONE

SILTSTONE

CLAYSTONE

CLAYSTONE

Clayey

Silty

Carbonaceous

COAL

CLAYSTONE- CARBONACEOUS

1/ Tested in accordance with ASTM D 422-63.

2/ Tested in accordance with ASTM D 423 and D 424.

3/ Tested in accordance with ASTM D 854 and Chleborad and others, 1975.

 $\underline{4/}$ Tested in accordance with method described by Franklin and Chandra, 1972.

<u>5</u>/ Tested in accordance with method described by Brock and Franklin, 1972. Calculated in meganewtons/meters² using the formula: U⁻I₈(50) X 24.

Diametral test (loaded parallel to bedding planes)

Axial test (loaded perpendicular to bedding planes)

6/ Tested in accordance with ASTM D 21166-66.

1986